

0935795-08240-1
FOI280-5625660

What is claimed is:

1. An optical disc apparatus having a focus jump function for enabling a focus control on each of a plurality of recording layers of a disc, comprising:

an objective lens for focusing laser light on a recording layer of the disc;

focus error signal generating means for generating a focus error signal based on reflection light that is obtained through the objective lens;

generating means for generating, based on the focus error signal, a focus control signal for controlling the objective lens;

drive voltage generating means for outputting a voltage necessary to move the objective lens;

moving means for moving the objective lens in a direction approximately perpendicular to the recording layers of the disc in accordance with the output voltage of the drive voltage generating means; and

speed detecting means for detecting a movement speed of the objective lens,

wherein a movement speed of the objective lens is detected during a focus jump, a lens drive signal corresponding to the detected movement speed is supplied to the moving means, and an end position of the focus jump is determined based on behavior of the focus error signal immediately before an end of the focus

jump, whereby a focus control is forcibly pulled, from a focus point corresponding to one recording layer, into a focus point corresponding to another recording layer.

2. The optical disc apparatus according to claim 1, further comprising means for monitoring a level of the focus error signal.

3. The optical disc apparatus according to claim 2, further comprising speed control voltage generating means for generating a voltage for controlling the objective lens based on the movement speed detected by the speed detecting means.

4. The optical disc apparatus according to claim 1, further comprising:

means for rejecting noise from the focus error signal;
means for monitoring a level of a signal obtained by rejecting the noise from the focus error signal; and

speed control voltage generating means for generating a voltage for controlling the objective lens based on the movement speed detected by the speed detecting means.

5. An optical disc apparatus having a focus jump function for enabling a focus control on each of a plurality of recording layers of a disc, comprising:

an objective lens for focusing laser light on a recording layer of the disc;

a signal processing circuit for generating a focus error signal based on reflection light that is obtained through the

objective lens;

a focus control circuit for generating, based on the focus error signal, a focus control signal for controlling the objective lens;

a drive voltage generating circuit for outputting a drive voltage necessary to move a focus position of the objective lens between recording layers;

an actuator for moving the objective lens in a direction approximately perpendicular to the recording layers of the disc in accordance with the output voltage of the drive voltage generating circuit; and

a differentiation circuit for detecting a movement speed of the objective lens by differentiating the focus error signal,

wherein a movement speed of the objective lens is detected during a focus jump, a lens drive signal corresponding to the detected movement speed is supplied to the actuator, and an end position of the focus jump is determined based on behavior of the focus error signal immediately before an end of the focus jump, whereby a focus control is forcibly pulled, from a focus point corresponding to one recording layer, into a focus point corresponding to another recording layer.

6. A focus jump method of an optical disc apparatus capable of performing a focus jump on a two-layer disc, wherein a target objective lens position of a focus control is determined by using a signal obtained by differentiating a focus

error signal.

7. An optical disc apparatus having a focus jump function for enabling a focus control on each of a plurality of recording layers of a disc on and from which data can be recorded and reproduced, comprising:

an objective lens for focusing laser light on a recording layer of the disc;

focus error signal generating means for generating a focus error signal based on reflection light that is obtained through the objective lens;

generating means for generating, based on the focus error signal, a focus control signal for controlling the objective lens;

drive voltage generating means for outputting a voltage necessary to move the objective lens;

moving means for moving the objective lens in a direction approximately perpendicular to the recording layers of the disc in accordance with the output voltage of the drive voltage generating means; and

control means for starting, when a focus jump becomes necessary during data recording, the focus jump after switching laser light power that is currently made high to enable the data recording to such a low power that neither data recording nor erasure can be effected.

8. An optical disc apparatus having a focus jump function

for enabling a focus control on each of a plurality of recording layers of a disc on and from which data can be recorded and reproduced, comprising:

an objective lens for focusing laser light on a recording layer of the disc;

a signal processing circuit for generating a focus error signal based on reflection light that is obtained through the objective lens;

a focus control circuit for generating, based on the focus error signal, a focus control signal for controlling the objective lens;

a drive voltage generating circuit for outputting a drive voltage necessary to move a focus position of the objective lens between recording layers;

an actuator for moving the objective lens in a direction approximately perpendicular to the recording layers of the disc in accordance with the output voltage of the drive voltage generating circuit; and

a control circuit for starting, when a focus jump becomes necessary during data recording, the focus jump after performing a control of switching laser light power that is currently made high to enable the data recording to such a low power that neither data recording nor erasure can be effected.

9. An optical disc apparatus having a focus jump function for enabling a focus control on each of a plurality of recording

layers of a disc on and from which data can be recorded and reproduced, comprising:

an objective lens for focusing laser light on a recording layer of the disc;

focus error signal generating means for generating a focus error signal based on reflection light that is obtained through the objective lens;

generating means for generating, based on the focus error signal, a focus control signal for controlling the objective lens;

drive voltage generating means for outputting a voltage necessary to move the objective lens;

moving means for moving the objective lens in a direction approximately perpendicular to the recording layers of the disc in accordance with the output voltage of the drive voltage generating means;

means for controlling power of a laser that is used for recording and reproducing data on and from the disk; and

control means for starting, when a focus jump becomes necessary during data recording, the focus jump after switching laser light power that is currently made high to enable the data recording to such a low power that neither data recording nor erasure can be effected.

10. An optical disc apparatus having a focus jump function for enabling a focus control on each of a plurality of recording

layers of a disc on and from which data can be recorded and reproduced, comprising:

an objective lens for focusing laser light on a recording layer of the disc;

a signal processing circuit for generating a focus error signal based on reflection light that is obtained through the objective lens;

a focus control circuit for generating, based on the focus error signal, a focus control signal for controlling the objective lens;

a drive voltage generating circuit for outputting a drive voltage necessary to move a focus position of the objective lens between recording layers;

an actuator for moving the objective lens in a direction approximately perpendicular to the recording layers of the disc in accordance with the output voltage of the drive voltage generating circuit;

a laser power control circuit for controlling power of a laser that is used for recording and reproducing data on and from the disk; and

a control circuit for starting, when a focus jump becomes necessary during data recording, the focus jump after performing a control of switching laser light power that is currently made high to enable the data recording to such a low power that neither data recording nor erasure can be effected

recording layer is prevented by controlling the moving means.

12. An optical disc apparatus having a focus jump function for enabling a focus control on each of a plurality of recording layers of a disc on and from which data can be recorded and reproduced, comprising:

an objective lens for focusing laser light on a recording layer of the disc;

a signal processing circuit for generating a focus error signal based on reflection light that is obtained through the objective lens;

a focus control circuit for generating, based on the focus error signal, a focus control signal for controlling the objective lens;

a drive voltage generating circuit for outputting a drive voltage necessary to move a focus position of the objective lens between recording layers;

an actuator for moving the objective lens in a direction approximately perpendicular to the recording layers of the disc in accordance with the output voltage of the drive voltage generating circuit; and

a comparison circuit for detecting, based on a level of the focus error signal, whether a focus position of the objective lens will deviate from a recording layer,

wherein when a focus jump is performed, whether the focus position of the objective lens will deviate from a destination

recording layer is detected and deviation from the destination recording layer is prevented by controlling the actuator.

13. The optical disc apparatus according to claim 11, wherein the deviation-from-layer detecting means compares the level of the focus error signal with a set level, and detects whether the focus position of the objective lens will deviate from a recording layer based on a magnitude relationship between the level of the focus error signal and the set level.

14. The optical disc apparatus according to claim 7, 9, or 11, wherein the drive voltage generating means generates a voltage value as an acceleration voltage that causes the objective lens to approach the disc and a voltage as a deceleration voltage that causes the objective lens to go away from the disc in moving the objective lens from one recording layer to another recording layer that is more distant from the objective lens than the one recording layer is, and wherein the drive voltage generating means generates a voltage value as an acceleration voltage that causes the objective lens to go away from the disc and a voltage as a deceleration voltage that causes the objective lens to approach the disc in moving the objective lens from one recording layer to another recording layer that is closer to the objective lens than the one recording layer is.

15. A focus jump method of an optical disc apparatus having a focus jump function for enabling a focus control on

each of a plurality of recording layers of a disc on and from which data can be recorded and reproduced, comprising the steps of:

detecting a current position of an objective lens while recording data on the disc;

judging whether a position where to record data next is located in a recording layer on which the objective lens is currently focused;

if it is judged that the position where to record data next is not located in a recording layer on which the objective lens is currently focused and hence a focus jump is necessary, switching laser power from a high power for data recording to such a low power that neither data recording nor erasure cannot be effected;

performing a focus jump after switching the laser power to the lower power;

judging whether a focus position of the objective lens will deviate from a target recording layer based on a level of a focus error signal that is obtained when the focus position of the objective lens reaches the target recording layer as a result of the focus jump;

if it is judged that the focus position of the objective lens will deviate from the target recording layer, performing control so that the focus position of the objective lens will not deviate from the target recording layer by driving the

objective lens forcibly;

judging whether the focus position of the objective lens has been pulled into the target recording layer by the control of preventing the focus position of the objective lens from deviating from the target recording layer;

if it is judged that the focus position of the objective lens has not been pulled into the target recording layer, performing a focus jump again from the start; and

if it is judged that the focus position of the objective lens has been pulled into the target recording layer, moving a laser spot to a target recording start position in the target recording layer, switching the laser power from the lower power to the high power, and restarting data recording.

16. The optical disc apparatus according to any one of claims 7 to 13, wherein a focus jump is necessary in a case where during continuous data recording there occurs data whose addresses bridge two recording layers, and a focus jump is started in processing an address portion that is not to be recorded on the disc after writing of a data portion.